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ELECTROMAGNETIC TYPE SPEAKER

Fumikazu Murakami

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ELECTROMAGNETIC TYPE SPEAKER

[Denjigata supiika]

Inventor:	Fumikazu Murakami
Applicant:	Daiichi Seikosha K.K.

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Claim

In an electromagnetic type speaker having a bottom yoke, a magnetic core that is attached in the center of the bottom yoke, a coil that is wound around the periphery of said magnetic core, a permanent magnet that is placed on top of the bottom yoke is on the periphery of said coil, and the above-mentioned magnetic core is arranged so as to maintain a suitable spacing, and has a movable iron disk that is affixed to a vibrating plate; a magnetic type speaker characterized in that a hollow disk-shaped upper yoke rides on top of the said permanent magnet, and the shape of the movable disk is made a hollow disk shape, or a hollow tube shape.

Detailed explanation of the invention

This invention relates to an improvement of an electromagnetic type speaker, and specifically, obtains a higher performance by means of improving the magnetic circuit construction.

Figure 1 is a cross-sectional view showing the construction of an electromagnetic type speaker used in the past. In Figure 1, (1) is a bottom yoke, in the center of said bottom yoke (1) a magnetic core (2) is provided, and on the periphery of that, a coil (3) is wound. (4) is a ring shaped permanent magnet, and is placed on top of the bottom yoke (1). (5) is a movable iron disk, affixed to the center of a vibrating plate (6) on which a bending process has been executed, and the periphery of the vibrating plate (6) is supported on a support frame (7). The above construction is in accordance with the well-known electromagnetic type speaker. In this construction, a magnetic force operates on the ends of the movable iron disk and the magnetic core, and that force F is expressed by

$$F = S/\mu_o \, (B_m^2+2B_mB_c+B_o^2) \cong\cong\cong \cong\cong\cong \cong\cong\cong (A)$$

Here,

S ≅≅≅ magnetic core cross-sectional area

μ_o ≅≅≅ reluctance of air

B_m ≅≅≅ magnetic flux density of magnetic gap due to magnetic flux generated from the permanent magnet

B_o ≅≅≅ magnetic flux density of magnetic gap due to magnetic flux generated by means of the coil current.

B_c is proportional to the coil current, and when a coil signal current flows, according to term two of equation A, a force proportional to the signal current is generated in the movable disk. In Equation A, term one is the force due to the magnetic flux of the permanent magnet, and shows a static attractive force. To obtain a signal sound with good efficiency, the value of term two in Equation A is made large, and in the magnetic gap, the magnetic flux density B_m from the permanent magnet, and the magnetic flux density B_c due to the coil are made large.

On the other hand, when considering the speaker's entire body, to obtain smooth frequency characteristics, a means is adopted which uses an inertia control region in a band that is above the resonant frequency of the vibrating plate. The sound level in this inertia control region greatly influences the mass of the vibrating system, and the smaller the mass, the higher the performance becomes.

From the above points, notice is taken of the fact that, when attempt is made to further improve the electromagnetic type speaker in Figure 1, the mass of the movable iron disk is lowered, but because the movable iron disk is a construction component of the magnetic circuit, it is necessary that the opposite effect of lessening the magnetic flux density B_m and B_c not be

generated. Also, this operates to shift the resonant frequency of the vibrating plate higher, and because it is undesirable at this point, a change such as lessening the effect so as to make bending of the vibrating plate easier is conducted, but if bending of the vibrating plate is made easier, the balance of the magnetic gap is upset, the movable iron disk and the magnetic core make contact, and instances of attracting and not separating can occur. Therefore, to the extent that the spring constant of the vibrating plate is lessened, a lowering of the B_m is conducted by means of lessening the attractive force (static attractive force) due to the permanent magnet.

In other words, in the improvement for the purpose of changing to high performance, it is necessary to exhibit the effects related to the unfavorable points, and naturally enough, with a change of the dimensions to a large size, it is difficult to say that it is a change to high performance.

A construction example according to this invention is in accordance with that shown in Figure 2. In Figure 2, (8) is a bottom yoke, a magnetic core (9) is provided in the center of the bottom yoke, and on its upper and face, a yoke (10) is fastened in which the outer diameter is larger than that of the magnetic core (9). A coil (11) is wound on the outer circumference of the magnetic core (9), and on the outer circumference of the said coil (11), a hollow ring shaped permanent magnet (12) is placed on top of the bottom yoke (8). At the upper end face of the permanent magnet (12) an upper yoke (13) of the same hollow ring shape is placed. At the upper end faces of these yokes (10) and (13), and with a thin spacing, the hollow disk shaped-movable iron disk (14) is arranged. Because it has a larger diameter, it performs the role of bending in the vicinity of the magnetic flux within the iron core (9), and in the magnetic gap with the movable iron disk, it is possible to make the movable disk hollow so as to have a cross-sectional area about the same as in the past. The yoke (10) rides on top of the magnetic core (9) in this example, but it is also possible to form it in one unit with the magnetic core (9), and, in that case, it is not necessarily of the configuration of this example, and depending on the size of the diameter of the magnetic core (9), it can be realized in the form of Figure 1.

The thickness of the movable iron disk (14) is determined from the consideration of not generating magnetic saturation, but it can be reduced by means of reducing the volume of the permanent magnet (12), and also by means of reducing the magnetic flux that passes through the movable iron disk.

As in the above, according to this invention, the mass of the movable iron disk can be lightened, and the sound level can be raised in the inertia control region. Because of the dimensions, there is no generation of unfavorable circumstances such as a change to a large size, and an increase in the resonant frequency, and it becomes possible to realize an improvement in performance.

The inner diameter of the movable iron disk (14) is at least smaller than the outer diameter of the above-mentioned yoke (10), and the outer diameter is at least larger than the inner diameter of the above-mentioned yoke (13). The movable iron disk (14) is fastened to a vibrating plate (15), and the circumference of the vibrating plate (15) is supported by means of a support frame (16).

According to the above construction, as for the movable iron disk (14), its thickness is made thin, and because it becomes hollow, its mass is made light. As a result, the performance is improved, and its appearance is [sic] presented.

First, in order to prevent an increase in the resonant frequency, the plate thickness and the elasticity of the vibrating plate (15) are set small. In order to solve the upset of the magnetic gap balance which accompanies this, the static attractive force is set low by means of lessening the thickness of the permanent magnet (12). Also, because the reduction of the B_m from the relationship of Equation A reduces the signal drive force, the upper yoke (13) is placed with the purport of augmenting this. By means of determining the above-mentioned yoke (13), the magnetic resistance seen from the coil magnetic force becomes small, and as a result, the B_c becomes large. In other words, this is because a yoke is present in the permanent magnet dedicated section used in the past.

Also, the yoke (10) is placed on top of the magnetic core (9), and the [text missing] of Figure 9.

Brief description of the figures

Figure 1 is a cross-sectional view of an electromagnetic type speaker used in the past, and Figure 2 is a cross-sectional view of an electromagnetic type speaker of an application example of this invention.

1, 8 Bottom yoke
2, 9 Magnetic core
3, 11 Coil
4, 12 Permanent magnet
5, 14 Movable iron disk
6, 15 Vibrating plate
7, 16 Support frame
10 Yoke
13 Upper yoke

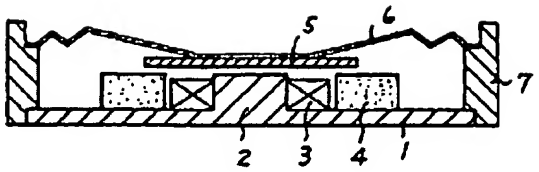

Figure 1

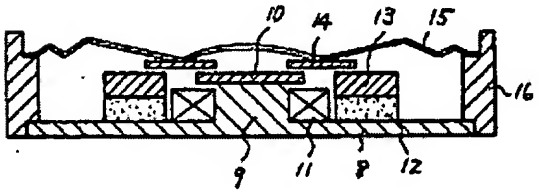

Figure 2